

these light bands that pass over the top and the sides of this terminal pouch, but there are none externally visible below, as that side is covered by the darker gland of the walls of the deferent duct. Internally oviduct and deferent duct are already separate. The deferent duct lies below and is covered above and on the sides by the white walls of the oviduct enveloping the top of the deferent duct with its thick glands. The diagonal bands are due to folds of the walls of the oviduct which are more than half a millimeter deep above and on the sides but much thinner below. Evidently the deep narrow clefts between the diagonal glandular folds account for the position of the ridges on the outside of the eggshell. The oviduct walls also have muscle fibers which doubtless play a part in forming the eggshell.

THE HABITATS OF IOWA SUCCINEAS

BY B. SHIMEK

The genus *Succinea* is often described as "amphibious." Of the species inhabiting Iowa this is strictly true only of *S. retusa*, though *S. concordialis* inhabits the muddy borders of lakes and streams (never, however, appearing in water), where it may be associated with *retusa*; while *S. avara*, though sometimes occurring with *S. retusa* on low, muddy flats, also extends well up into upland woods in contiguous territory, being our most adaptable species.

The remaining species, *ovalis* and *grosvenorii*, display certain peculiarities of habitat and distribution which are worthy of note.

Succinea ovalis Say is found in more or less scattered areas in all wooded parts of the state. In the eastern part the writer has almost invariably found it in low, alluvial woods, subject to overflow. During flood times the animals creep up on the trunks of trees and the stems of coarse plants which project above the water; but at other times during the open season they may be found creeping about on various plants, to which they may also remain attached during drier parts of the day or season after forming a thin, transparent epiphragm; or they may creep about on the moist ground or hide under logs. During the late fall or winter they hibernate under the fallen leaves of bottomland

trees, lying with the aperture uppermost, the latter covered with an opaque white epiphragm.

In 57 years of field experience in eastern Iowa, the writer has found but one exception to the rule that this species is found in low alluvial bottomlands. In April, 1901, a scattered colony was found at Iowa City on the rocky, wooded bluff below what is now the University President's house. They ranged from 25 to 75 feet above the river, thus being entirely above the highest flood level. After a prolonged search nearly 50 specimens were found, all living. They were all under sticks and leaves, and none had the winter epiphragm.

In the far western part of the state, however, this species is distinctly more xerophilous, being found most frequently in upland bur-oak groves, or in thickets bordering upon them, where it occurs scattered, or in small colonies. The writer has collected small sets in the border thickets on the high hills included in and adjoining Fairmount Park at Council Bluffs, and in upland, rather open, bur-oak groves in Mills, Harrison and Monona Counties, in all cases on loess ridges, and in some cases at heights fully 150 feet above the river-valley.

These western forms are usually somewhat smaller than the more typical eastern forms, with a somewhat longer spire and narrower aperture, but most of the bottomland specimens from eastern Iowa are of much the same type, though occasionally showing the larger form with broader aperture. The variation of the entire series is much the same as that which occurs in the loess fossils of this species in the same region, showing quite the same range in both form and distribution.

Succinea grosvenorii Lea is the most unique of our species of this genus, both in distribution and habitat. It has been found as far north as Ft. Simpson on the upper Mackenzie River, and it extends southward, east of the Rocky Mts., to Louisiana and Texas. Eastward, however, it seems to be limited to close proximity to the Missouri River, and to that of the Mississippi below the mouth of the former.

In all this range, unlike most of the other species of the genus, it is usually subject to xeric conditions, and this is true even of the lower Mississippi region, as will be shown.

In most of the published reports of this species no habitat is given,—a very common fault of local reports on molluses,—and in several others the habitat, as given, is widely variant from that which the writer has observed along its eastern limit. Thus, Simpson (Conchologists' Exchange, vol. I, 1887, p. 65) reports it from the vicinity of Ogallala in western Nebraska, as abundant "in pools of alkali water near the South Platte River, in early spring." Walker (NAUTILUS, vol. 20, 1906, p. 81) states that it occurs in the Salt Basin at Lincoln, Nebraska, and at Hackberry Lake in Cherry County, of the same state. Hanna (*l.c.*, vol. 23, 1909, p. 96) says that in Douglas County, Nebraska, it was "found in colonies in wet places," while Over (*l.c.*, p. 92) notes it as common "on plains and prairies." More recently, Cheatum and Burt (Field and Laboratory, vol. II, no. 2, 1934, p. 50) report that in Dallas County, Texas, "it has been collected in swampy regions, as well as under thin blankets of humus in relatively dry areas." They refer it to localities (described in *l.c.*, vol. II, no. 1, 1933) which are mostly wooded and swampy.

With the exception of a small set collected in the Salt Basin at Lincoln, Nebraska, in 1889, the writer has never found the species living excepting on loess banks or bluffs along the Missouri River in Iowa (as far north as Sioux City), Nebraska and Missouri; on the west side of the Mississippi in Arkansas, and on the east side of the same stream in Kentucky, Tennessee, Mississippi and Louisiana.

The specimens were usually few and scattered, and this was true even in the two localities in which the species was obtained in greatest numbers, namely, at Hamburg, Iowa, and Natchez, Mississippi. In the former locality about 100 specimens were collected, most of them dead, while in the latter about 500 living specimens were secured after several days of incidental search.

Throughout this loess bluffs range the habits and habitat of this species were quite uniform. In drier weather the scattered individuals were found clinging to the bare faces of the loess bluffs, or on the equally bare upper parts of the talus at their base, and always on the more sheltered sides, either facing north, or protected by turns and crevices in the bluffs.

When thus found, they almost invariably cling with the aper-

ture (covered by a thin, transparent epiphragm) pressed against the face of the bluff. The epiphragm is quite readily dissolved on the return of moisture, but equally readily formed when necessary.

They creep about in moister weather, or during the early morning hours in drier periods, but close up promptly as soon as dry conditions return.

In the north a few specimens have been found late in the season, evidently tucked away for the winter, with thick, opaque, white epiphragms. These were found mostly in sheltered crevices.

The habitat of this species on loess bluffs has probably been overlooked by shell collectors because ordinarily no one would look for land snails in such barren, dry places. The writer's innumerable contacts with loess exposures throughout the Mississippi and Missouri valleys, however, brought them to light quite frequently.

It is evident that this species selects two quite different major habitats, namely, that noted above, and another on the plains which may be quite moist or wet, but more or less alkaline or saline. To the latter group belong those reported in the references quoted above (with the exception of the last), and also the sets which the writer has received from South Dakota, Kansas and Texas.

Both types, however, are distinctly xeric. The plains alkaline ponds and moist spots are very dry during much of the average summer, and even when wet, they are strongly xeric, as shown by the character of their scant vegetation. The loess bluffs are likewise subject to periodic xeric conditions, and this is true even in the southern mesic climate, for during drier seasons, and even during different hours of the day, they may be quite dry. It is evident, therefore, that this species is far removed in habit from the co-generic "amphibious" and mesophilous forms, and is a distinct xerophile.

As a loess fossil this species extends at least from Illinois to Nebraska, and formerly thus evidently reached far beyond its present eastern limits. It does not seem to be found in the far southern loess, though the range of the modern form extends at

least to its southern limit. The food and resting habits of this species are worthy of further study, and this should be undertaken by those who live in the region of its occurrence.

It is certain that both *S. grosvenorii* and the upland form of *S. ovalis*, are quite xerophilous, the former somewhat more so, and that both occur in closely contiguous places in the western part of the state, sometimes so close together that they appear to be mixed, just as they are in the loess. They, with other species with which they are associated, again suggest that the climate during the deposition of the loess of Iowa and vicinity was not moist and cold, but may have been quite as warm and dry as that of western Iowa is to-day.

The variation in habits and form of these species, quite as strikingly duplicated in some others, should also lead to caution in forming judgment concerning climatic conditions of past periods of time. Hasty conclusions based on individual species are always unwise; it is always safer to take entire faunas into account. If this were done we might have fewer "theories" and wildly fantastic explanations, but some of our scientific work would rest on a sounder foundation.

NEW SPECIES AND RACES OF LYMNÆIDAE FROM NEWFOUNDLAND

BY FRANK C. BAKER AND STANLEY T. BROOKS

In July, 1934, the junior author made a trip to the Island of Newfoundland for the purpose of collecting its molluscan fauna. This territory is, as far as the mollusks are concerned, almost a *terra incognita*, and it is not surprising that new forms should be found, since the region is completely isolated from the mainland and from adjacent islands. A complete report on the Mollusca collected will be published by the junior author.

Stagnicola palustris papyracea nov. var.

Shell differing from *S. p. ungava* F. C. Baker in being more ovate with spire and aperture about equal in length, the whorls of the spire not as high as in those of *ungava*, the sutures less deeply indented; inner lip narrow, the columellar plait quite distinct and the umbilical chink small or absent; color light